



## **Evaluating Beneficial Use: Human Health (Fish Consumption)**



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## E1. Background

The State of Ohio has operated a formal Fish Consumption Advisory (FCA) Program since 1993. Since July 2002, the program's technical and decision-making expertise has been housed at Ohio EPA. The risk assessment protocols used were developed in the early 1990s under the auspices of the Great Lakes Governors Association.

Ohio has adopted human health water quality standards (WQS) criteria to protect the public from adverse impacts, both carcinogenic and non-carcinogenic, due to exposure via drinking water (applicable at public water supply intakes) and to exposure from the contaminated flesh of sport fish (applicable in all surface waters). The latter criterion is called the non-drinking water human health criterion. The purpose of that criterion is to ensure levels of a chemical in water do not bioaccumulate in fish to levels harmful to people who catch and eat the fish. The relationship of the non-drinking water human health criterion to the FCA risk assessment protocols is explained below.

## E2. Rationale and Evaluation Method

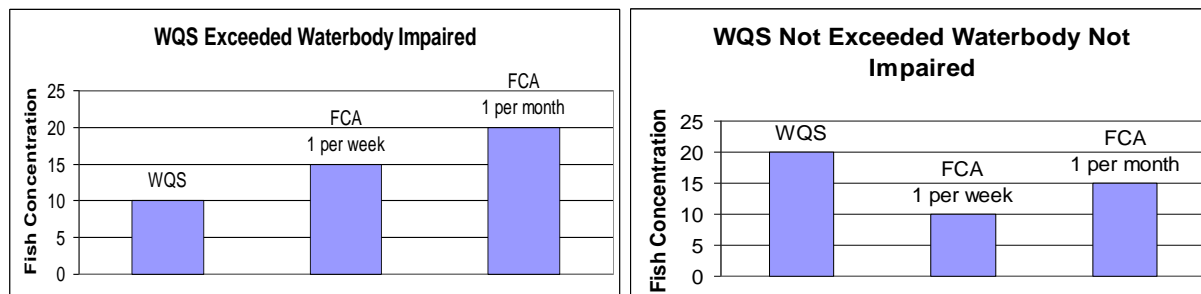
U.S. EPA's guidance for preparing the 2006 Integrated Report (IR) states:

*Although the CWA [Clean Water Act] does not explicitly direct the use of fish and shellfish consumption advisories or NSSP [National Shellfish Sanitation Program] classifications to determine attainment of water quality standards, states are required to consider all existing and readily available data and information to identify impaired segments on their section 303(d) lists. For purposes of determining whether a segment is impaired and should be included on a section 303(d) list, EPA considers a fish or shellfish consumption advisory, a NSSP classification, and the supporting data to be existing and readily available data and information that demonstrates non-attainment of a section 101(a) "fishable" use when:*

- *the advisory is based on fish and shellfish tissue data,*
- *a lower than "Approved" NSSP classification is based on water column and shellfish tissue data (and this is not a precautionary "Prohibited" classification or the state water quality standard does not identify lower than "Approved" as attainment of the standard),*
- *the data are collected from the specific segment in question, and*
- *the risk assessment parameters (e.g., toxicity, risk level, exposure duration and consumption rate) of the advisory or classification are cumulatively equal to, or less protective than those in the State's WQS" (U.S. EPA, 2005).*

Ohio's WQS regulations do not describe human consumption of sport fish as an explicit element of aquatic life protection. However, the WQS regulations do include human health criteria that are applicable to all surface waters of the State. Certain of these criteria are derived using assumptions about the bioaccumulation of chemicals in the food chain and the criteria are intended to protect people from adverse health impacts that could arise from consuming fish caught in Ohio's waters. To determine when and how waters should be listed as impaired because of FCAs, the risk assessment parameters on which the human health WQS criteria are based were compared with those used in the Ohio FCA program. If the State has issued an advisory for a specific water body and that advisory is equal to or less protective than the State's WQS, then one can assume there is an exceedance of the

WQS. On the other hand, if the advisory is more protective than the WQS, one cannot assume that the issuance of the advisory indicates an exceedance of the WQS. Figure E-1 illustrates this point.



**Figure E-1. Illustration of the relationship among the WQS values, the values that trigger issuance of FCAs and the resulting decision regarding water body impairment associated with an FCA.**

A fish consumption advisory is determined based on the quantity of a chemical in fish, such as micrograms of chemical per kilogram of fish tissue ( $\mu\text{g}/\text{kg}$ ). WQS, on the other hand, are expressed as the quantity of chemical in water, such as micrograms of chemical per liter of water ( $\mu\text{g}/\text{L}$ ). The information used to calculate the human health non-drinking WQS criterion can be used to calculate a maximum safe fish concentration. The fish concentration value can then be directly compared to the FCA program values to determine whether the advisory is less or more protective than the WQS criterion. The values in Table E-1 make this comparison for chemicals for which there are both an FCA and an Ohio human health non-drinking water criterion. Because Ohio human health criteria differ between the Lake Erie and Ohio River basins, separate comparisons are presented.

These constituents shown in Table E-1 were chosen based on U.S. EPA's recommendations on page 53 of its 2006 IR Guidance (<http://www.epa.gov/sites/production/files/2015-10/documents/2006irg-report.pdf>; U.S. EPA, 2006a). Hexachlorobenzene and mirex were added because of historic fish tissue contamination with those contaminants.

The table demonstrates that the levels of fish tissue contaminants that trigger a fish advisory have little obvious relation to the levels of fish tissue contaminants on which the WQS criteria are based. This discrepancy exists because different assumptions about fish consumption rates are made in calculating water quality standards than in issuing fish advisories. For example, the fish consumption rate used to calculate the Ohio River Basin WQS criteria is 17.5 grams per day. The fish consumption rate used to calculate a “one meal per week” advisory recommendation is 32.6 grams per day. These values are not the same because the WQS criteria fish consumption rates are based on nutritional studies that attempt to capture approximately how much sport caught fish people are eating, whereas the fish consumption advisory rates are meant to advise people how much fish they can safely consume.

**Table E-1. Comparison between fish concentration values and FCA program values.**

Basin / Parameter	Fish concentration on which the WQS is based <sup>1</sup>	Range of fish concentrations triggering an “eat no more than one meal per week” advisory	Range of fish concentrations triggering an “eat no more than one meal per month” advisory
Lake Erie / PCB	23 µg/kg	50 - 220 µg/kg	221 - 1,000 µg/kg
Ohio River / PCB	54 µg/kg	50 - 220 µg/kg	221 - 1,000 µg/kg
Lake Erie / mercury	350 µg/kg	110 - 220 µg/kg	221 - 1,000 µg/kg
Ohio River / mercury	1,000 µg/kg	110 - 220 µg/kg	221 - 1,000 µg/kg
Lake Erie / DDT	140 µg/kg	500 - 2,188 µg/kg	2,189 – 9,459 µg/kg
Ohio River / DDT	320 µg/kg	500 - 2,188 µg/kg	2,189 – 9,459 µg/kg
Lake Erie / Chlordane	130 µg/kg	500 - 2,188 µg/kg	2,189 – 9,459 µg/kg
Ohio River / Chlordane	310 µg/kg	500 - 2,188 µg/kg	2,189 – 9,459 µg/kg
Lake Erie / Hexachlorobenzene	29 µg/kg	800 - 3,499 µg/kg	3,500 - 15,099 µg/kg
Ohio River / hexachlorobenzene	67 µg/kg	800 - 3,499 µg/kg	3,500 - 15,099 µg/kg
Lake Erie/ mirex	88 µg/kg	200 - 874 µg/kg	875 - 3,783 µg/kg
Ohio River/ mirex	200 µg/kg	200 - 874 µg/kg	875 - 3,783 µg/kg

Values	Advisory is less protective than the WQS criterion, WQS exceeded, water body impaired
Values	Advisory is more protective than WQS criterion, WQS not exceeded, no impairment from FCA
Values	Advisory may be more, or less, protective than WQS criterion

U.S. EPA stipulates that the risk assessment parameters used to categorize fish tissue contaminant data must be at least as protective as those used in the WQS-based fish concentrations. Fish advisory contaminant levels are not directly related to the WQS criteria contaminant levels and in some cases are not as protective. Therefore, Ohio EPA has elected to directly compare fish tissue data with the WQS criteria calculations shown in the above table, instead of using advisory-based categorizations.

The following steps were utilized to determine a 303(d) list category for waters based on fish tissue contaminant data:

#### **Step 1: Determine available data**

All data in the fish tissue database were evaluated for the 2016 IR. The most recent 10 years of data collections, 2005-2014, were used for making category 1 and category 5 determinations. In cases where multiple years of data were available in that 10-year window, all data were weighted equally. In cases where the only data available were older than 2005, the category determined by those data became historical (i.e., impaired-historical or unimpaired-historical).

<sup>1</sup> See Section E4 for an explanation of how these concentrations were calculated.

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Ohio's Credible Data Law states that all data greater than five years in age will be considered historical and that it can be used as long as the director has identified compelling reasons as to why the data are credible. In the case of fish tissue, the use of data older than five but ten or fewer years old is necessary. This is because not enough fish tissue samples are gathered from enough locations each year to conduct a thorough assessment of contaminant levels in fish tissue across the state. Frequently, multiple sampling years are needed to make a determination about issuing or rescinding an advisory. Owing to limited staff time and budget resources, it sometimes takes over five years to revisit a location and collect more fish tissue samples. A more complete picture of contaminants in fish tissue is presented when data are utilized that reach back 10 years.

## **Step 2: Determine fish tissue contaminant concentrations**

For streams in each assessment unit (AU)<sup>2</sup>, a weighted average based on species and trophic level was calculated for each contaminant. One year of data was considered adequate to categorize the fish as impaired or unimpaired. Inland lakes are considered a component of the assessment unit(s) in which they are geographically located, so sample results may affect the assessment status of the AU(s) and the index scores for the AU(s). Inland lakes are also analyzed individually; results are displayed in Table E-12.

## **Step 3: Determine adequate species data**

In order to assess an AU as category 1 or 5, at least four samples from that AU are needed, with at least two samples from each of trophic levels three and four. An exception was made for AUs with 10 or more samples from one trophic level and only one sample from the other trophic level.

A geometric mean was calculated for each species and then a weighted average was calculated for each trophic level. A weighted average for each AU was then calculated using the consumption rates found in the water quality criteria calculations. That weighted average was then compared against the contaminant levels listed in Table E-1 and categorized as category 1 or 5.

In cases where those data requirements were not met, an AU was classified as category 3i. In cases where no data were available, an AU was classified as category 3.

This calculation methodology is derived from the methodology described in Section 4.3.2 of the document Guidance for Implementing the January 2001 Methylmercury Water Quality Criterion, Final, U.S. EPA Office of Science and Technology, EPA-823-R-09-002, January 2009 (<http://www.epa.gov/waterscience/criteria/methylmercury/pdf/guidance-final.pdf>).

For the Lake Erie Basin:

$$C_{avgLEB} = \frac{3.6 * C_3 + 11.4 * C_4}{15} = 0.27 \text{ mg/kg}$$

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<sup>2</sup> Assessment units include both watershed assessment units (12-digit hydrologic units) and large river assessment units (generally rivers that drain more than 500 square miles).

For the Ohio River Basin:

$$C_{avgORB} = \frac{11.8 * C_3 + 5.7 * C_4}{17.5} = 0.18 \text{ mg/kg}$$

Where:

C<sub>3</sub> = average concentration for trophic level 3

C<sub>4</sub> = average concentration for trophic level 4

**Table E-2. Example data for calculating a weighted average fish tissue value.**

Species	Trophic Level	Number of Samples	Geometric mean mercury concentration (mg/kg)
Black crappie ( <i>Pomoxis nigromaculatus</i> )	3	1	0.085
Bluegill sunfish ( <i>Lepomis macrochirus</i> )	3	2	0.098
Channel catfish ( <i>Ictalurus punctatus</i> )	3	2	0.145
Common carp ( <i>Cyprinus carpio</i> )	3	3	0.120
Largemouth bass ( <i>Micropterus salmoides</i> )	4	3	0.212
Smallmouth bass ( <i>Micropterus dolomieu</i> )	4	1	0.421
Spotted bass ( <i>Micropterus punctulatus</i> )	4	1	0.347

#### **Step 4: Determine appropriate assessment unit divisions**

It should be recognized that in determining impairment status based on AUs instead of individual water bodies, extrapolations to water bodies without data are made. In some cases, water bodies that have no data will be categorized as impaired if they are within an impaired AU.

Inland lakes are treated as individual water bodies for impairment purposes regardless of whether they are entirely contained within an AU or straddle more than one AU and results for individual lakes are shown in Table E-12. In addition, any AU containing all or part of an impaired inland lake was considered to be not supporting the beneficial use (see Step 2 above for further explanation).

#### **Step 5: Categorize water bodies within assessment units**

##### *Category 5 – Impaired*

Any AU meeting the data requirements in step 3 with a weighted average fish tissue concentration of PCBs, mercury, DDT, chlordane, or hexachlorobenzene above the WQS-based fish tissue concentration is placed into category 5. When the data indicating impairment are older than 10 years, the AU remains impaired but is considered impaired-historical, category 5h<sup>3</sup>.

<sup>3</sup> An “h” subcategory could indicate one of two possibilities. In IRs prior to 2010, when Ohio reported on the larger assessment units, categories were assigned based on data collected anywhere in that unit. For the 2010 analysis, the 2008 category was assigned to each of the new, smaller units. If the original data were collected before 1999,

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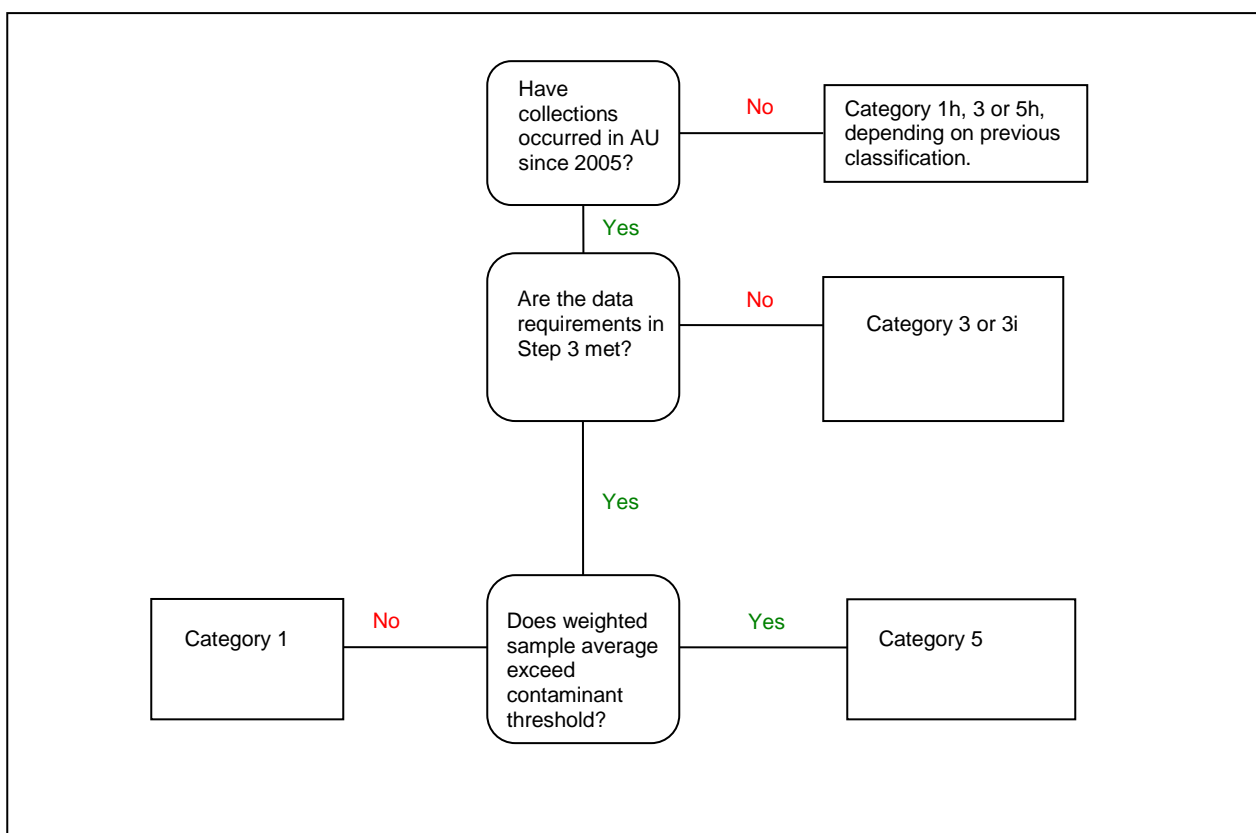
### *Category 1 – Not Impaired*

To be categorized as category 1, not impaired, an AU must meet the data requirements in step 3 and the weighted average concentration of a contaminant must be below the threshold that would trigger an impairment. AUs that had previously been considered category 1, but with no data since 2005, were reclassified as Category 1h<sup>2</sup>.

### *Category 3 – Insufficient or No Data*

Any AU in which current data are available but those data are insufficient according to step 3 (to categorize the AU as category 1 or 5), the AU was listed as category 3i. If no data were available for an AU, the category was listed as 3. If an AU had previously been classified as category 3 or 3i and there were no data in the AU since 2005, the AU was classified as category 3.

Please see Figure E-2 for a summary of the procedure detailed previously.



**Figure E-2. Flow chart for the categorization of fish tissue data for the IR.**

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a re-analysis of the data could not be completed for the 2010 report, so the smaller units retained the category of the larger unit. In some cases, the data were collected within the smaller assessment unit and in other cases they were not. For the older data, a distinction between the two could not be made for this report. In addition, data collected prior to 2005 are considered historical in the 2016 analysis.



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## E3. Results

Fish tissue data for six contaminants were reviewed to determine an IR attainment status. The methodology for selecting, reviewing and categorizing fish tissue data is given in Section E2. The six contaminants reviewed were mercury, PCBs, chlordane, DDT, mirex and hexachlorobenzene. These contaminants were chosen for review based on current and recent fish consumption advisories in Ohio caused by these contaminants, as well as existing human health WQS criteria for the six contaminants.

There were a total of 152 changes to the human health attainment statuses of assessment units for the 2016 IR which are summarized in Table E-3. The primary reasons for change in status include data having become historical and the collection and analysis of new information.

**Table E-3. A summary of changes in attainment status from 2014 to 2016 IR.**

Reason for change		Changes
<b>Data have become historical</b>		<b>29</b>
	<i>Category 1 to 1h</i>	<i>12</i>
	<i>Category 3i to 3</i>	<i>11</i>
	<i>Category 5 to 5h</i>	<i>6</i>
<b>New data</b>		<b>123</b>
	<i>Became category 1</i>	<i>63</i>
	<i>Became category 3i</i>	<i>31</i>
	<i>Became category 5</i>	<i>29</i>
<b>Total changes</b>		<b>152</b>

Detailed results are presented in Tables E-4 through E-12. Detailed information on specific fish consumption advisories including geographic extent of the advisory, type and size of fish affected and consumption advice can be found at <http://www.epa.ohio.gov/dsw/fishadvisory/index.aspx>.

Table E-4 lists waters impaired because fish tissue levels of PCBs or mercury exceed the threshold level upon which the WQS criterion is based, while Table E-5 includes those not impaired. Table E-6 lists water bodies identified as impaired for this use on a previous 303(d) list that are no longer considered impaired, either because of new data or the updated methodology described in Section E1. There are three WAUs in Ohio with significant pollution resulting in 303(d) listings from other contaminants that affect fish tissue, as shown in Table E-7. Remediation activities on most of these water bodies are underway. In Tables E-8 and E-9, the data for all these locations have become historical and new data would need to be collected before a current impairment status can be determined. Since age of data alone is not a reason for delisting, the water bodies in Table E-9 remain on the 303(d) list. Table E-10 lists waters with current fish tissue data where inadequate samples exist to determine level of impairment. Sites in Table E-10 have never had sufficient data for assessment, now or in the past. Table E-11 lists large rivers and their impairment status. Table E-12 lists inland lake impairment status.

**Table E-4. Waters not supporting the human health use because levels of PCBs or mercury in fish tissue exceed the threshold level upon which the WQS criterion is based. These waters are category 5.**

Water Body (Category 5: Impaired)	Assessment Unit	Pollutant
Heldman Ditch-Ottawa River	04100001 03 07	PCBs
Sibley Creek-Ottawa River	04100001 03 08	PCBs
West Branch St Joseph River	04100003 02 04	PCBs
Cogswell Cemetery-St Joseph River	04100003 03 02	PCBs
Willow Run-St Joseph River	04100003 05 05	PCBs, Mercury
Prairie Creek-St Marys River	04100004 02 05	PCBs
Flat Run-Tiffin River	04100006 03 03	Mercury
Village of Stryker-Tiffin River	04100006 05 03	PCBs
Sixmile Creek-Auglaize River	04100007 02 04	PCBs
Lima Reservoir-Ottawa River	04100007 03 06	PCBs
Dog Creek	04100007 08 01	PCBs
Lower Town Creek	04100007 08 04	PCBs
Big Run-Flatrock Creek	04100007 12 06	PCBs
Howard Run-Blanchard River	04100008 03 04	PCBs
Heilman Ditch-Swan Creek	04100009 08 04	PCBs
Rhodes Ditch-South Branch Portage River	04100010 02 04	PCBs
North Branch Portage River	04100010 03 01	PCBs
Portage River	04100010 05 02	PCBs
Lower Toussaint Creek	04100010 06 03	PCBs
Town of Lindsey-Muddy Creek	04100011 14 04	PCBs
Huron River-Frontal Lake Erie	04100012 06 06	PCBs
Baker Creek-West Branch Rocky River	04110001 01 08	PCBs
Rocky River	04110001 02 03	PCBs
Jackson Ditch-East Branch Black River	04110001 04 04	Mercury
Lower West Branch Black River	04110001 05 06	PCBs
Black River	04110001 06 02	PCBs
Ladue Reservoir-Bridge Creek	04110002 01 04	PCBs
Lake Rockwell-Cuyahoga River	04110002 02 03	PCBs
Wingfoot Lake outlet-Little Cuyahoga River	04110002 03 03	PCBs
Fish Creek-Cuyahoga River	04110002 03 05	PCBs
Boston Run-Cuyahoga River	04110002 04 05	PCBs
Lower Ashtabula River	04110003 01 05	PCBs
Griswold Creek-Chagrin River	04110003 04 02	PCBs, DDT
Town of Jefferson-Mill Creek	04110004 04 03	Mercury
Headwaters Middle Fork Little Beaver Creek	05030101 04 02	Mirex
Elk Run-Middle Fork Little Beaver Creek	05030101 04 05	PCBs
Long Run-Yellow Creek	05030101 07 04	PCBs
Hollow Rock Run-Yellow Creek	05030101 08 04	PCBs

Water Body (Category 5: Impaired)	Assessment Unit	Pollutant
Lower Cross Creek	05030101 10 05	PCBs
Fish Creek-Mahoning River	05030103 01 03	PCBs
Deer Creek	05030103 02 01	PCBs
Island Creek-Mahoning River	05030103 02 04	PCBs
Kirwin Reservoir-West Branch Mahoning River	05030103 03 04	PCBs
Charley Run Creek-Mahoning River	05030103 03 06	PCBs
Lower Mosquito Creek	05030103 05 03	PCBs
Lower Meander Creek	05030103 07 03	PCBs
Dry Fork-Short Creek	05030106 02 07	PCBs
Cox Run-Wheeling Creek	05030106 03 03	PCBs
Lower McMahan Creek	05030106 07 04	PCBs
Pea Vine Creek-Captina Creek	05030106 09 05	PCBs
Eightmile Creek-Little Muskingum River	05030201 07 05	PCBs
Sugar Creek-Duck Creek	05030201 09 04	PCBs
Portage Lakes-Tuscarawas River	05040001 01 05	PCBs
Headwaters Sandy Creek	05040001 04 06	PCBs
Armstrong Run-Sandy Creek	05040001 06 05	PCBs
Beal Run-Sandy Creek	05040001 06 07	PCBs, Hexachlorobenzene
Headwaters Clear Fork Mohican River	05040002 03 01	PCBs
Switzer Creek-Clear Fork Mohican River	05040002 04 05	PCBs
Dillon Lake-Licking River	05040006 06 03	PCBs
Dudley Run-Rush Creek	05060001 02 03	PCBs
Greenbrier Creek-Big Darby Creek	05060001 22 03	PCBs
Lizard Run-Big Darby Creek	05060001 22 04	PCBs
Deer Creek Lake-Deer Creek	05060002 02 05	PCBs
Scippo Creek	05060002 04 05	PCBs
Sour Run-Little Salt Creek	05060002 08 05	PCBs
Poe Run-Salt Creek	05060002 09 06	PCBs
Pee Pee Creek	05060002 11 04	PCBs
Leeth Creek-Sunfish Creek	05060002 12 06	PCBs
Big Run-Scioto River	05060002 16 02	PCBs
Dividing Branch-Greenville Creek	05080001 11 03	PCBs
Beals Run-Indian Creek	05080002 08 03	PCBs
Ice Creek	05090103 01 03	PCBs
Storms Creek	05090103 01 04	PCBs
Wards Run-Little Scioto River	05090103 06 05	PCBs
Soldiers Run-Ohio Brush Creek	05090201 05 06	PCBs
Newman Run-Little Miami River	05090202 05 04	PCBs
West Fork-Mill Creek	05090203 01 05	PCBs
Grand Lake-St Marys	05120101 02 04	PCBs

**Table E-5. Waters fully supporting the human health use because fish tissue levels of PCBs or mercury are below the threshold level upon which the WQS criterion is based. These waters are category 1.**

Water Body (Category 1: Unimpaired)	Assessment Unit
Headwaters Tenmile Creek	04100001 03 04
Clear Fork-East Branch St Joseph River	04100003 01 06
Nettle Creek	04100003 03 01
Fourmile Creek-St Marys River	04100004 01 06
Yankee Run-St Marys River	04100004 03 03
Town of Willshire-St Marys River	04100004 03 05
Bates Creek-Tiffin River	04100006 03 01
Village of Buckland-Auglaize River <sup>4</sup>	04100007 02 02
Sims Run-Auglaize River	04100007 02 03
Lost Creek	04100007 03 05
Wolf Ditch-Little Auglaize River	04100007 06 03
Dry Fork-Little Auglaize River	04100007 06 04
West Branch Prairie Creek	04100007 07 02
Prairie Creek	04100007 07 03
Burt Lake-Little Auglaize River	04100007 08 06
Big Run-Auglaize River	04100007 09 04
City of Findlay Riverside Park-Blanchard River	04100008 02 05
East Branch Portage River	04100010 02 02
Green Creek	04100011 12 03
City of Medina-West Branch Rocky River	04110001 01 05
Cossett Creek-West Branch Rocky River	04110001 01 06
Headwaters East Branch Rocky River	04110001 02 01
Baldwin Creek-East Branch Rocky River	04110001 02 02
Town of Litchfield-East Branch Black River	04110001 04 01
Salt Creek-East Branch Black River	04110001 04 02
Wellington Creek	04110001 05 03
East Branch Reservoir-East Branch Cuyahoga River	04110002 01 01
Mogadore Reservoir-Little Cuyahoga River	04110002 03 02
Peters Creek-Mill Creek	04110004 04 02
Town Fork	05030101 08 01
McIntyre Creek	05030101 10 04
Hardin Run-Ohio River	05030101 11 06
Pymatuning Reservoir	05030102 01 05
Booth Run-Pymatuning Creek	05030102 03 04
Town of Newton Falls-West Branch Mahoning River	05030103 03 05
Mouth Eagle Creek	05030103 04 05
Middle Mosquito Creek	05030103 05 02

<sup>4</sup> Shaded rows indicate WAUs that would be impaired if the U.S. EPA mercury criterion of 0.3 mg/kg were effective.

Water Body (Category 1: Unimpaired)	Assessment Unit
Andersons Run-Mill Creek	05030103 08 03
North Fork Captina Creek	05030106 09 01
South Fork Captina Creek	05030106 09 02
Forked Run-Ohio River	05030202 04 04
West Creek-Ohio River	05030202 08 04
Center Branch	05030204 01 01
Turkey Run-Rush Creek	05030204 02 04
East Branch Sunday Creek	05030204 07 01
Willow Creek-Hocking River	05030204 10 01
Nimisila Reservoir-Nimisila Creek	05040001 03 02
Buttermilk Creek-Stillwater Creek	05040001 13 04
Brushy Fork	05040001 14 02
Craborchard Creek-Stillwater Creek	05040001 14 03
Upper Little Stillwater Creek	05040001 15 03
Weaver Run-Stillwater Creek	05040001 16 03
Headwaters North Branch Kokosing River	05040003 01 01
Little Jelloway Creek	05040003 04 01
Brush Run-Kokosing River	05040003 04 03
Big Run-Killbuck Creek	05040003 08 04
Bucklew Run-Killbuck Creek	05040003 08 05
Reasoners Run-Olive Green Creek	05040004 11 04
Trail Run-Wills Creek	05040005 02 07
Beeham Run-Salt Fork	05040005 04 06
Wolf Run-Wills Creek	05040005 05 08
Twomile Run-Wills Creek	05040005 06 02
Wills Creek Dam-Wills Creek	05040005 06 04
Mouth Wills Creek	05040005 06 05
Buckeye Lake	05040006 04 03
Rocky Fork	05040006 05 03
Gander Run-Scioto River	05060001 04 01
Town of La Rue-Scioto River	05060001 04 05
Lower Mill Creek	05060001 06 04
O'Shaughnessy Dam-Scioto River	05060001 12 02
Hayden Run-Scioto River	05060001 12 04
Hoover Reservoir-Big Walnut Creek	05060001 13 08
Alum Creek Dam-Alum Creek	05060001 14 04
Town of Carroll-Walnut Creek	05060001 17 05
Big Run-Walnut Creek	05060001 18 05
Spain Creek-Big Darby Creek	05060001 19 02
Robinson Run-Big Darby Creek	05060001 19 05

Water Body (Category 1: Unimpaired)	Assessment Unit
Barron Creek-Little Darby Creek	05060001 20 05
Thomas Ditch-Little Darby Creek	05060001 20 06
Worthington Ditch-Big Darby Creek	05060001 21 01
Silver Ditch-Big Darby Creek	05060001 21 02
Richmond Ditch-Deer Creek	05060002 01 02
Turkey Run-Deer Creek	05060002 01 06
Town of Mount Sterling-Deer Creek	05060002 02 04
Blue Creek-Salt Creek	05060002 06 05
Stony Creek-Scioto River	05060002 10 05
Headwaters Morgan Fork	05060002 12 02
Little Beaver Creek-Big Beaver Creek	05060002 13 03
Town of Washington Court House-Paint Creek	05060003 01 03
Cliff Creek-Paint Creek	05060003 06 03
Mud Run-North Fork Paint Creek	05060003 08 05
Indian Lake-Great Miami River	05080001 01 03
Stoney Creek	05080001 04 03
Lake Loramie-Loramie Creek	05080001 05 03
Mosquito Creek	05080001 07 02
Garbry Creek-Great Miami River	05080001 07 05
Headwaters Greenville Creek	05080001 10 04
Bridge Creek-Greenville Creek	05080001 11 02
Town of Covington-Stillwater River	05080001 12 05
Clarence J Brown Lake-Buck Creek	05080001 17 05
Dry Run-Wolf Creek	05080002 01 03
Rush Run-Sevenmile Creek	05080002 05 04
Ninemile Creek-Sevenmile Creek	05080002 05 05
Cotton Run-Four Mile Creek	05080002 06 05
Camp Creek-Symmes Creek	05090101 09 03
Pigeon Creek-Symmes Creek	05090101 10 03
Aaron Creek-Symmes Creek	05090101 10 04
Howard Run-Pine Creek	05090103 02 04
Lick Run-Pine Creek	05090103 02 05
McDowell Creek-Little Scioto River	05090103 05 04
McConnel Creek-Rocky Fork	05090103 06 03
Headwaters Turkey Creek	05090201 02 01
Little East Fork-Ohio Brush Creek	05090201 05 01
Lick Fork	05090201 05 02
Middle Caesar Creek	05090202 04 04
Lower Caesar Creek	05090202 04 06
Headwaters Cowan Creek	05090202 06 04

Water Body (Category 1: Unimpaired)	Assessment Unit
Wilson Creek-Cowan Creek	05090202 06 05
Headwaters East Fork Little Miami River	05090202 10 02
Todd Run-East Fork Little Miami River	05090202 11 03
Lucy Run-East Fork Little Miami River	05090202 12 03
Headwaters Stonelick Creek	05090202 13 01
Lick Fork-Stonelick Creek	05090202 13 04
Salt Run-East Fork Little Miami River	05090202 13 05

**Table E-6. Waters fully supporting the human health use because fish tissue levels of PCBs or mercury are below the threshold level upon which the WQS criterion is based and which were categorized as impaired in the 2014 IR. These waters have become category 1 with the current assessment.**

Water Body (Newly Unimpaired for 2016)	Assessment Unit	Reason for delisting
Headwaters Tenmile Creek	04100001 03 04	New Data
Yankee Run-St Marys River	04100004 03 03	New Data
Bates Creek-Tiffin River	04100006 03 01	New Data
East Branch Portage River	04100010 02 02	New Data
City of Medina-West Branch Rocky River	04110001 01 05	New Data
Headwaters East Branch Rocky River	04110001 02 01	New Data
Baldwin Creek-East Branch Rocky River	04110001 02 02	New Data
Town of Litchfield-East Branch Black River	04110001 04 01	New Data
Salt Creek-East Branch Black River	04110001 04 02	New Data
Town Fork	05030101 08 01	New Data
McIntyre Creek	05030101 10 04	New Data
Town of Newton Falls-West Branch Mahoning River	05030103 03 05	New Data
Mouth Eagle Creek	05030103 04 05	New Data
Spain Creek-Big Darby Creek	05060001 19 02	New Data
Robinson Run-Big Darby Creek	05060001 19 05	New Data

**Table E-7. Waters with contaminants other than PCBs and mercury that affect fish tissue (included on the 303(d) list). These waters are category 5.**

Water Body (Impaired by Other Pollutants)	Assessment Unit	Pollutant
Griswold Creek-Chagrin River	04110003 04 02	DDTs
Beal Run-Sandy Creek	05040001 06 07	Hexachlorobenzene
Headwaters Middle Fork Little Beaver Creek	05030101 04 02	Mirex

**Table E-8. Waters for which the existing unimpaired status cannot be confirmed because data have become historical and not enough new data are available. These waters are category 1h.**

Water Body (Category 1h: Unimpaired, Historic Data)	Assessment Unit
Mud Creek	04100006 06 02
Lower Bad Creek	04100009 03 02
Mouth Tymochtee Creek	04100011 06 05
Little Sandusky River	04100011 07 01
Norwalk Creek	04100012 06 03
Coon Creek-East Branch Black River	04110001 03 03
Charlemont Creek	04110001 05 01
Sawyer Brook-Cuyahoga River	04110002 01 06
Mud Brook	04110002 04 01
Middle Ashtabula River	04110003 01 04
Middle Rock Creek	04110004 02 02
Griggs Creek	04110004 04 01
Bronson Creek-Grand River	04110004 05 02
Little Yellow Creek	05030101 11 02
Carpenter Run-Ohio River	05030101 11 03
Headwaters West Fork Duck Creek	05030201 09 01
Groundhog Creek-Ohio River	05030202 08 02
Oldtown Creek-Ohio River	05030202 08 03
Broad Run-Ohio River	05030202 08 05
Headwaters Hocking River	05030204 04 01
Clear Fork	05030204 06 01
Fourmile Creek	05030204 10 03
Seymour Run-Black Fork	05040002 02 02
East Branch Kokosing River	05040003 01 02
Jug Run-Wakatomika Creek	05040004 01 04
Town of Frazesburg-Wakatomika Creek	05040004 02 04
Bacon Run	05040005 06 01
White Eyes Creek	05040005 06 03
Big Run	05040006 06 02
Headwaters Olentangy River	05060001 08 01
Headwaters Whetstone Creek	05060001 09 02
Claypool Run-Whetstone Creek	05060001 09 03
Beaver Run-Olentangy River	05060001 10 03
Brandige Run-Olentangy River	05060001 10 05
Indian Run-Olentangy River	05060001 10 06
Delaware Run-Olentangy River	05060001 10 07
Deep Run-Olentangy River	05060001 11 01
Rush Run-Olentangy River	05060001 11 02



Water Body (Category 1h: Unimpaired, Historic Data)	Assessment Unit
Mouth Olentangy River	05060001 11 03
West Branch Alum Creek	05060001 14 01
Headwaters Alum Creek	05060001 14 02
Big Run-Alum Creek	05060001 14 03
Headwaters Walnut Creek	05060001 17 02
Hellbranch Run	05060001 22 01
South Fork Rocky Fork	05060003 05 01
Clear Creek	05060003 05 02
Headwaters Rocky Fork	05060003 05 03
Rocky Fork Lake-Rocky Fork	05060003 05 04
Franklin Branch-Rocky Fork	05060003 05 05
North Fork Great Miami River	05080001 01 01
South Fork Great Miami River	05080001 01 02
South Fork Stillwater River	05080001 09 01
Headwaters Stillwater River	05080001 09 02
North Fork Stillwater River	05080001 09 03
Boyd Creek	05080001 09 04
Woodington Run-Stillwater River	05080001 09 05
Town of Beamsville-Stillwater River	05080001 09 06
Indian Creek	05080001 12 01
Swamp Creek	05080001 12 02
Trotters Creek	05080001 12 03
Harris Creek	05080001 12 04
Lesley Run-Twin Creek	05080002 02 05
Town of Gratis-Twin Creek	05080002 03 04
Town of Germantown-Twin Creek	05080002 03 06
Headwaters Sevenmile Creek	05080002 05 01
Paint Creek	05080002 05 02
Beasley Run-Sevenmile Creek	05080002 05 03
Headwaters Four Mile Creek	05080002 06 01
Little Four Mile Creek	05080002 06 02
East Fork Four Mile Creek-Four Mile Creek	05080002 06 03
Acton Lake Dam-Four Mile Creek	05080002 06 04
Town of Zaleski-Raccoon Creek	05090101 02 05
Headwaters Little Raccoon Creek	05090101 04 01
Bundle Run-Ohio Brush Creek	05090201 05 03
North Branch Caesar Creek	05090202 04 01
Upper Caesar Creek	05090202 04 02
South Branch Caesar Creek	05090202 04 03
Flat Fork	05090202 04 05

Water Body (Category 1h: Unimpaired, Historic Data)	Assessment Unit
Dutch Creek	05090202 06 01
Headwaters Todd Fork	05090202 06 02
Lytle Creek	05090202 06 03
Little Creek-Todd Fork	05090202 06 06
Turtle Creek	05090202 10 01
Headwaters Dodson Creek	05090202 10 03
Anthony Run-Dodson Creek	05090202 10 04
West Fork East Fork Little Miami River	05090202 10 05
Glady Creek-East Fork Little Miami River	05090202 10 06
Solomon Run-East Fork Little Miami River	05090202 11 01
Fivemile Creek-East Fork Little Miami River	05090202 11 02
Poplar Creek	05090202 12 01
Cloverlick Creek	05090202 12 02
Backbone Creek-East Fork Little Miami River	05090202 12 04
Brushy Fork	05090202 13 02
Moore Fork-Stonelick Creek	05090202 13 03

**Table E-9. Waters for which the existing impaired status cannot be confirmed because data have become historical and not enough new data are available. These waters are category 5h.**

*Note: The waters remain on the 303(d) list.*

Water Body (Category 5h: Impaired, Historic Data)	Assessment Unit
Shantee Creek	04100001 03 01
Halfway Creek	04100001 03 02
Prairie Ditch	04100001 03 03
North Tenmile Creek	04100001 03 05
Tenmile Creek	04100001 03 06
Eagle Creek	04100003 03 03
Village of Montpelier-St Joseph River	04100003 03 04
Bear Creek	04100003 03 05
West Buffalo Cemetery-St Joseph River	04100003 03 06
Bluff Run-St Joseph River	04100003 05 01
Big Run	04100003 05 02
Russell Run-St Joseph River	04100003 05 03
Sol Shank Ditch-St Joseph River	04100003 05 06
Muddy Creek	04100004 01 01
Center Branch St Marys River	04100004 01 02
East Branch St Marys River	04100004 01 03
Kopp Creek	04100004 01 04
Sixmile Creek	04100004 01 05
Hussey Creek	04100004 02 01

Water Body (Category 5h: Impaired, Historic Data)	Assessment Unit
Eightmile Creek	04100004 02 02
Blierdofer Ditch	04100004 02 03
Twelvemile Creek	04100004 02 04
Little Black Creek	04100004 03 01
Black Creek	04100004 03 02
Duck Creek	04100004 03 04
Leatherwood Creek	04100006 03 02
Beaver Creek	04100006 05 01
Brush Creek	04100006 05 02
Buckskin Creek-Tiffin River	04100006 06 04
Headwaters Auglaize River	04100007 01 01
Blackhoof Creek	04100007 01 02
Wrestle Creek-Auglaize River	04100007 01 03
Pusheta Creek	04100007 01 04
Two Mile Creek	04100007 02 01
Upper Hog Creek	04100007 03 01
Middle Hog Creek	04100007 03 02
Little Hog Creek	04100007 03 03
Lower Hog Creek	04100007 03 04
Little Ottawa River	04100007 04 01
Dug Run-Ottawa River	04100007 04 02
Honey Run	04100007 04 03
Pike Run	04100007 04 04
Leatherwood Ditch	04100007 04 05
Beaver Run-Ottawa River	04100007 04 06
Sugar Creek	04100007 05 01
Plum Creek	04100007 05 02
Village of Kalida-Ottawa River	04100007 05 03
Upper Jennings Creek	04100007 09 01
West Jennings Creek	04100007 09 02
Lower Jennings Creek	04100007 09 03
Prairie Creek	04100007 09 06
Cessna Creek	04100008 01 01
Headwaters Blanchard River	04100008 01 02
The Outlet-Blanchard River	04100008 01 03
Potato Run	04100008 01 04
Ripley Run-Blanchard River	04100008 01 05
Brights Ditch	04100008 02 01
The Outlet	04100008 02 02
Findlay Upground Reservoirs-Blanchard River	04100008 02 03

Water Body (Category 5h: Impaired, Historic Data)	Assessment Unit
Lye Creek	04100008 02 04
Upper Eagle Creek	04100008 03 01
Lower Eagle Creek	04100008 03 02
Aurand Run	04100008 03 03
Tiderishi Creek	04100008 05 01
Ottawa Creek	04100008 05 02
Moffitt Ditch	04100008 05 03
Dukes Run	04100008 05 04
Dutch Run	04100008 05 05
Town of Pemberville-Portage River	04100010 03 02
Sugar Creek	04100010 04 01
Larcarpe Creek Outlet #4-Portage River	04100010 04 02
Little Portage River	04100010 05 01
Upper Tousant Creek	04100010 06 01
Packer Creek	04100010 06 02
Headwaters Paramour Creek-Sandusky River	04100011 04 01
Loss Creek-Sandusky River	04100011 04 02
Headwaters Middle Sanduskey River	04100011 04 03
Grass Run	04100011 04 04
Headwaters Lower Sandusky River	04100011 04 05
Town of Upper Sandusky-Sandusky River	04100011 07 02
Negro Run	04100011 07 03
Cranberry Run-Sandusky River	04100011 07 04
Sugar Run-Sandusky River	04100011 07 05
Clear Creek-Vermilion River	04100012 01 01
Buck Creek	04100012 01 02
Southwest Branch Vermilion River	04100012 01 03
New London Upground Reservoir-Vermilion River	04100012 01 04
Indian Creek-Vermilion River	04100012 01 05
East Branch Vermilion River	04100012 02 01
East Fork Vermilion River	04100012 02 02
Town of Wakeman-Vermilion River	04100012 02 03
Mouth Vermilion River	04100012 02 04
Plum Creek	04110001 01 01
North Branch West Branch Rocky River	04110001 01 02
Headwaters West Branch Rocky River	04110001 01 03
Mallet Creek	04110001 01 04
Plum Creek	04110001 01 07
East Fork of East Branch Black River	04110001 03 01
Headwaters West Fork East Branch Black River	04110001 03 02

Water Body (Category 5h: Impaired, Historic Data)	Assessment Unit
Willow Creek	04110001 04 03
Upper West Branch Black River	04110001 05 02
Middle West Branch Black River	04110001 05 04
Plum Creek	04110001 05 05
French Creek	04110001 06 01
West Branch Cuyahoga River	04110002 01 02
Tare Creek-Cuyahoga River	04110002 01 03
Black Brook	04110002 01 05
Potter Creek-Breakneck Creek	04110002 02 01
Feeder Canal-Breakneck Creek	04110002 02 02
Plum Creek	04110002 03 01
City of Akron-Little Cuyahoga River	04110002 03 04
Yellow Creek	04110002 04 02
Furnace Run	04110002 04 03
Brandywine Creek	04110002 04 04
Pond Brook	04110002 05 01
Headwaters Tinkers Creek	04110002 05 02
Headwaters Chippewa Creek	04110002 05 03
Town of Twinsburg-Tinkers Creek	04110002 05 04
East Branch Ashtabula River	04110003 01 01
West Branch Ashtabula River	04110003 01 02
Upper Ashtabula River	04110003 01 03
Dead Branch	04110004 01 01
Headwaters Grand River	04110004 01 02
Baughman Creek	04110004 01 03
Swine Creek	04110004 01 06
Upper Rock Creek	04110004 02 01
Lower Rock Creek	04110004 02 03
Phelps Creek	04110004 03 01
Hoskins Creek	04110004 03 02
Mill Creek-Grand River	04110004 03 03
Mud Creek	04110004 03 04
Plumb Creek-Grand River	04110004 03 05
Three Brothers Creek-Grand River	04110004 05 01
East Branch Middle Fork Little Beaver Creek	05030101 04 01
Stone Mill Run-Middle Fork Little Beaver Creek	05030101 04 03
Lisbon Creek-Middle Fork Little Beaver Creek	05030101 04 04
Longs Run	05030101 06 01
Honey Creek	05030101 06 02
Headwaters North Fork Little Beaver Creek	05030101 06 03

Water Body (Category 5h: Impaired, Historic Data)	Assessment Unit
Little Bull Creek	05030101 06 04
Headwaters Bull Creek	05030101 06 05
Leslie Run-Bull Creek	05030101 06 06
Dilworth Run-North Fork Little Beaver Creek	05030101 06 07
Brush Run-North Fork Little Beaver Creek	05030101 06 08
Rough Run-Little Beaver Creek	05030101 06 09
Bieler Run-Little Beaver Creek	05030101 06 10
Headwaters Yellow Creek	05030101 07 01
Elkhorn Creek	05030101 07 02
Upper North Fork	05030101 07 03
Headwaters North Fork Yellow Creek	05030101 08 02
Salt Run-North Fork Yellow Creek	05030101 08 03
Upper Cross Creek	05030101 10 01
Salem Creek	05030101 10 02
Middle Cross Creek	05030101 10 03
Frontal Pymatuning Reservoir	05030102 01 04
Willow Creek	05030103 02 02
Mill Creek	05030103 02 03
Kale Creek	05030103 03 01
Headwaters West Branch Mahoning River	05030103 03 02
Barrel Run	05030103 03 03
Headwaters Eagle Creek	05030103 04 01
South Fork Eagle Creek	05030103 04 02
Camp Creek-Eagle Creek	05030103 04 03
Tinkers Creek	05030103 04 04
Burgess Run-Yellow Creek	05030103 08 06
Crabapple Creek	05030106 03 01
Headwaters Wheeling Creek	05030106 03 02
Flat Run-Wheeling Creek	05030106 03 04
Buffalo Run-West Fork Duck Creek	05030201 09 02
New Years Creek-Duck Creek	05030201 09 03
Horse Cave Creek	05030202 03 01
Headwaters East Branch Shade River	05030202 03 02
Big Run-East Branch Shade River	05030202 03 03
Spruce Creek-Shade River	05030202 03 04
Baldwin Run	05030204 04 02
Pleasant Run	05030204 04 03
Tarhe Run-Hocking River	05030204 04 04
Buck Run-Hocking River	05030204 04 05
Scott Creek	05030204 06 02

Water Body (Category 5h: Impaired, Historic Data)	Assessment Unit
Oldtown Creek	05030204 06 03
Fivemile Creek	05030204 06 04
Headwaters Tuscarawas River	05040001 01 01
Pigeon Creek	05040001 01 02
Hudson Run	05040001 01 03
Wolf Creek	05040001 01 04
Headwaters Chippewa Creek	05040001 02 01
Hubbard Creek-Chippewa Creek	05040001 02 02
Little Chippewa Creek	05040001 02 03
River Styx	05040001 02 04
Tommy Run-Chippewa Creek	05040001 02 05
Red Run	05040001 02 06
Silver Creek-Chippewa Creek	05040001 02 07
Pancake Creek-Tuscarawas River	05040001 03 01
Lake Lucern-Nimisila Creek	05040001 03 03
Fox Run	05040001 03 04
Headwaters Newman Creek	05040001 03 06
Town of North Lawrence-Newman Creek	05040001 03 07
Sippo Creek	05040001 03 08
Conser Run	05040001 04 01
Middle Branch Sandy Creek	05040001 04 02
Pipes Fork-Still Fork	05040001 04 03
Muddy Fork	05040001 04 04
Reeds Run-Still Fork	05040001 04 05
Swartz Ditch-Middle Branch Nimishillen Creek	05040001 05 01
East Branch Nimishillen Creek	05040001 05 02
West Branch Nimishillen Creek	05040001 05 03
City of Canton-Middle Branch Nimishillen Creek	05040001 05 04
Sherrick Run-Nimishillen Creek	05040001 05 05
Town of East Sparta-Nimishillen Creek	05040001 05 06
Hugle Run	05040001 06 01
Pipe Run	05040001 06 02
Black Run	05040001 06 03
Little Sandy Creek	05040001 06 04
Indian Run-Sandy Creek	05040001 06 06
Village of Pavonia-Black Fork Mohican River	05040002 02 01
Headwaters Rocky Fork	05040002 02 03
Outlet Rocky Fork	05040002 02 04
Charles Mill-Black Fork Mohican River	05040002 02 05
Headwaters Wakatomika Creek	05040004 01 01

Water Body (Category 5h: Impaired, Historic Data)	Assessment Unit
Winding Fork	05040004 01 02
Brushy Fork	05040004 01 03
Black Run-Walatomika Creek	05040004 02 01
Mill Fork	05040004 02 02
Little Wakatomika Creek	05040004 02 03
Claylick Creek	05040006 05 01
Lost Run	05040006 05 02
Rock Fork	05060001 03 01
Honey Creek-Little Scioto River	05060001 03 04
Panther Creek	05060001 04 02
Wolf Creek-Scioto River	05060001 04 03
Wildcat Creek	05060001 04 04
Glade Run-Scioto River	05060001 04 06
Mud Run	05060001 08 02
Flat Run	05060001 08 03
Town of Caledonia-Olentangy River	05060001 08 04
Shaw Creek	05060001 09 01
Otter Creek-Olentangy River	05060001 10 01
Grave Creek	05060001 10 02
Qu Qua Creek	05060001 10 04
Pawpaw Creek	05060001 17 01
Poplar Creek	05060001 17 03
Sycamore Creek	05060001 17 04
Georges Creek	05060001 18 01
Tussing Ditch-Walnut Creek	05060001 18 02
Turkey Run	05060001 18 03
Little Walnut Creek	05060001 18 04
Mud Run-Walnut Creek	05060001 18 06
Headwaters Big Darby Creek	05060001 19 01
Buck Run	05060001 19 03
Sugar Run	05060001 19 04
Headwaters Treacle Creek	05060001 20 01
Proctor Run-Treacle Creek	05060001 20 02
Headwaters Little Darby Creek	05060001 20 03
Spring Fork	05060001 20 04
Gay Run-Big Darby Creek	05060001 22 02
Grove Run-Scioto River	05060001 23 04
Hargus Creek	05060002 04 01
Yellowbud Creek	05060002 04 02
Congo Creek	05060002 04 04



Water Body (Category 5h: Impaired, Historic Data)	Assessment Unit
Beech Fork	05060002 06 01
Headwaters Salt Creek	05060002 06 02
Laurel Run	05060002 06 03
Pine Creek	05060002 06 04
East Fork Queer Creek	05060002 09 01
Queer Creek	05060002 09 02
Pretty Run	05060002 09 03
Pike Run	05060002 09 04
Village of Eagle Mills-Salt Creek	05060002 09 05
Indian Creek	05060002 10 01
Dry Run	05060002 10 02
Headwaters Walnut Creek	05060002 10 03
Lick Run-Walnut Creek	05060002 10 04
Headwaters Paint Creek	05060003 01 01
East Fork Paint Creek	05060003 01 02
Indian Creek-Paint Creek	05060003 06 01
Farmers Run-Paint Creek	05060003 06 02
Cherokee Mans Run	05080001 03 01
Rennick Creek-Great Miami River	05080001 03 02
Rum Creek	05080001 03 03
Blue Jacket Creek	05080001 03 04
Bokengehalas Creek	05080001 03 05
Brandywine Creek-Great Miami River	05080001 03 06
McKees Creek	05080001 04 01
Lee Creek	05080001 04 02
Indian Creek	05080001 04 04
Plum Creek	05080001 04 05
Turkeyfoot Creek-Great Miami River	05080001 04 06
Machochee Creek	05080001 15 01
Headwaters Mad River	05080001 15 02
Kings Creek	05080001 15 03
Gladys Creek-Mad River	05080001 15 04
Muddy Creek	05080001 16 01
Dugan Run	05080001 16 02
Nettle Creek	05080001 16 03
Anderson Creek	05080001 16 04
Storms Creek	05080001 16 05
Chapman Creek	05080001 16 06
Bogles Run-Mad River	05080001 16 07
Moore Run	05080001 18 01

Water Body (Category 5h: Impaired, Historic Data)	Assessment Unit
Pondy Creek-Mad River	05080001 18 02
Mill Creek	05080001 18 03
Donnels Creek	05080001 18 04
Rock Run-Mad River	05080001 18 05
Jackson Creek-Mad River	05080001 18 06
Mud Creek	05080001 19 01
Mud Run	05080001 19 02
Poplar Creek-Great Miami River	05080001 20 05
North Branch Wolf Creek	05080002 01 01
Headwaters Wolf Creek	05080002 01 02
Holes Creek	05080002 01 04
Millers Fork	05080002 02 01
Headwaters Twin Creek	05080002 02 02
Swamp Creek	05080002 02 03
Price Creek	05080002 02 04
Bantas Fork	05080002 03 01
Aukerman Creek	05080002 03 02
Toms Run	05080002 03 03
Little Twin Creek	05080002 03 05
Elk Creek	05080002 07 01
Shaker Creek	05080002 07 03
Dicks Creek	05080002 07 04
Gregory Creek	05080002 07 05
Pleasant Run	05080002 09 01
Paddys Run	05080002 09 03
Taylor Creek	05080002 09 05
Hales Creek	05090103 02 01
Headwaters Pine Creek	05090103 02 02
Little Pine Creek	05090103 02 03
Big Threemile Creek	05090201 06 04
Headwaters Little Miami River	05090202 01 01
North Fork Little Miami River	05090202 01 02
Buffenbarger Cemetery-Little Miami River	05090202 01 03
Yellow Springs Creek-Little Miami River	05090202 01 04
North Fork Massies Creek	05090202 02 01
South Fork Massies Creek	05090202 02 02
Massies Creek	05090202 02 03
Little Beaver Creek	05090202 02 04
Beaver Creek	05090202 02 05
Shawnee Creek-Little Miami River	05090202 02 06

Water Body (Category 5h: Impaired, Historic Data)	Assessment Unit
Sugar Creek	05090202 05 01
Town of Bellbrook-Little Miami River	05090202 05 02
Glady Run	05090202 05 03
East Fork Mill Creek-Mill Creek	05090203 01 01
West Fork Mill Creek	05090203 01 02
Sharon Creek-Mill Creek	05090203 01 03
Congress Run-Mill Creek	05090203 01 04
Chickasaw Creek	05120101 02 01
Headwaters Beaver Creek	05120101 02 02
Coldwater Creek	05120101 02 03

**Table E-10. Waters with current fish tissue data where inadequate samples exist to determine impairment status. These waters are category 3i.**

Water Body (Category 3i: Insufficient Data)	Assessment Unit
Cornell Ditch-Fish Creek	04100003 04 06
Lower Lick Creek	04100006 04 04
Dry Run-Auglaize River	04100007 01 05
Middle Creek	04100007 08 05
Lower Blue Creek	04100007 10 04
Upper Powell Creek	04100007 11 02
Lower Powell Creek	04100007 11 03
Eagle Creek-Auglaize River	04100007 12 09
Village of Gilboa-Blanchard River	04100008 05 06
Grassy Creek	04100009 09 02
Delaware Creek-Maumee River	04100009 09 04
Town of Bloomdale-South Branch Portage River	04100010 02 03
Otter Creek-Frontal Lake Erie	04100010 07 06
Mills Creek	04100011 01 03
Pickrel Creek	04100011 02 03
Raccoon Creek	04100011 02 04
Beaver Creek	04100011 12 02
Muskellunge Creek	04100011 13 01
Frink Run	04100012 05 03
Marsh Run-Conneaut Creek	04120101 06 05
Chocolate Run-Mahoning River	05030103 04 06
Piney Creek-Captina Creek	05030106 09 04
Cat Run-Captina Creek	05030106 09 06
Lower Sunfish Creek	05030201 01 04
Straight Fork-Little Muskingum River	05030201 06 05
Wingett Run-Little Muskingum River	05030201 07 03

Water Body (Category 3i: Insufficient Data)	Assessment Unit
Mouth Clear Creek	05030204 03 02
Brandywine Creek-Sugar Creek	05040001 11 05
Evans Creek	05040001 19 01
Jerome Fork-Mohican River	05040002 06 05
Town of Perrysville-Black Fork Mohican River	05040002 08 02
Big Run-Black Fork Mohican River	05040002 08 03
Job Run-North Branch Kokosing River	05040003 01 03
Granny Creek-Kokosing River	05040003 02 03
Delano Run-Kokosing River	05040003 03 04
Indianfield Run-Kokosing River	05040003 03 07
Jennings Ditch-Killbuck Creek	05040003 06 04
Buckeye Fork	05040004 04 04
Painter Creek-Jonathon Creek	05040004 04 07
Manns Fork Salt Creek	05040004 06 05
Flat Run-Muskingum River	05040004 08 02
Depue Run-Seneca Fork	05040005 01 04
Chapman Run	05040005 02 06
Salt Fork Lake-Sugartree Fork	05040005 04 05
Sarchet Run-Wills Creek	05040005 05 04
Headwaters Little Scioto River	05060001 03 02
City of Marion-Little Scioto River	05060001 03 03
Brush Run-Bokes Creek	05060001 07 02
Smith Run-Bokes Creek	05060001 07 03
Eversole Run	05060001 12 01
Dear Creek Dam-Deer Creek	05060002 02 07
State Run-Deer Creek	05060002 03 04
Lick Run-Scioto River	05060002 05 03
Headwaters Little Salt Creek	05060002 08 01
Buckeye Creek	05060002 08 02
Horse Creek-Little Salt Creek	05060002 08 03
Big Branch-Rattlesnake Creek	05060003 04 07
Biers Run-North Fork Paint Creek	05060003 09 04
Dismal Creek	05080001 10 01
Ludlow Creek	05080001 14 02
Sinking Creek	05080001 17 03
Town of New Miami-Great Miami River	05080002 07 06
Banklick Creek-Great Miami River	05080002 09 02
Sterling Run	05090201 10 01
Bear Creek-Ohio River	05090201 11 06
Mouth Anderson Fork	05090202 03 03

Water Body (Category 3i: Insufficient Data)	Assessment Unit
East Fork Todd Fork	05090202 07 01
Headwaters Wabash River	05120101 01 01

**Table E-11. Large rivers and their impairment status.**

Water Body (Large Rivers)	Assessment Unit	Impairment Status
Auglaize River (Ottawa River to mouth)	04100007 90 01	Impaired (PCBs)
Blanchard River (Dukes Run to mouth)	04100008 90 01	Impaired (PCBs)
Cuyahoga River (Brandywine Cr. to mouth)	04110002 90 01	Impaired (PCBs)
Grand River (Mill Creek to mouth)	04110004 90 01	Impaired (historical)
Great Miami River (Four Mile Creek to Ohio River)	05080002 90 02	Impaired (PCBs)
Great Miami River (Mad River to Four Mile Creek)	05080002 90 01	Impaired (PCBs)
Great Miami River (Tawawa Creek to Mad River)	05080001 90 01	Impaired (PCBs)
Hocking River (Scott Creek to Margaret Creek)	05030204 90 01	Impaired (historical)
Hocking River (Margaret Creek to Ohio River)	05030204 90 02	Impaired (historical)
Licking River (entire length); excluding Dillon Lake	05040006 90 01	Impaired (PCBs)
Little Miami River (Caesar Creek to O'Bannon Creek)	05090202 90 01	Impaired (PCBs)
Little Miami River (O'Bannon Creek to Ohio River)	05090202 90 02	Impaired (PCBs)
Mad River (Donnels Creek to mouth)	05080001 90 03	Impaired (historical)
Mahoning River (Eagle Creek to Pennsylvania Border)	05030103 90 01	Impaired (PCBs)
Maumee River (Beaver Creek to Maumee Bay)	04100009 90 02	Impaired (PCBs)
Maumee River (IN border to Tiffin River)	04100005 90 01	Impaired (PCBs)
Maumee River (Tiffin River to Beaver Creek)	04100009 90 01	Impaired (PCBs, mercury)
Mohican River (entire length)	05040002 90 01	Impaired (PCBs)
Muskingum River (Licking River to Meigs Creek)	05040004 90 02	Impaired (PCBs)
Muskingum River (Meigs Creek to Ohio River)	05040004 90 03	Impaired (PCBs)
Muskingum River (Tuscarawas/Walhonding confluence to Licking River)	05040004 90 01	Impaired (PCBs)
Paint Creek (Rocky Fork to mouth)	05060003 90 01	Impaired (PCBs)
Raccoon Creek (Little Raccoon Creek to mouth)	05090101 90 01	Insufficient data
Sandusky River (Tymochtee Creek to Wolf Creek)	04100011 90 01	Impaired (PCBs)
Sandusky River (Wolf Creek to Sandusky Bay)	04100011 90 02	Impaired (PCBs)
Scioto River (Big Darby Creek to Paint Creek)	05060002 90 01	Impaired (PCBs)
Scioto River (L. Scioto R. to Olentangy R.)	05060001 90 01	Impaired (PCBs)
Scioto River (Olentangy River to Big Darby Creek)	05060001 90 02	Impaired (PCBs)
Scioto River (Paint Creek to Sunfish Creek)	05060002 90 02	Impaired (PCBs)
Scioto River (Sunfish Creek to Ohio River)	05060002 90 03	Impaired (PCBs)
Stillwater River (Greenville Creek to mouth)	05080001 90 02	Not impaired
Tiffin River (Brush Creek to mouth)	04100006 90 01	Impaired (PCBs)
Tuscarawas River (Chippewa Creek to Sandy Creek)	05040001 90 01	Impaired (historical)
Tuscarawas River (Sandy Creek to Stillwater Creek)	05040001 90 02	Impaired (historical)

Water Body (Large Rivers)	Assessment Unit	Impairment Status
<b>Tuscarawas River (Stillwater Creek to Muskingum River)</b>	05040001 90 03	<b>Impaired (historical)</b>
<b>Walhonding River (entire length)</b>	05040003 90 01	<b>Impaired (PCBs)</b>
<b>Whitewater River (entire length)</b>	05080003 90 01	<b>Impaired (PCBs)</b>
Wills Creek (Salt Fork to mouth)	05040005 90 01	Insufficient data

**Table E-12. Inland lakes and their impairment status.**

Water Body (Inland Lakes)	Impairment status (cause)
Acton Lake	Not Impaired
Adams Lake	Not Impaired
Alum Creek Reservoir	Not Impaired
Amick Reservoir	Insufficient data
Apple Valley Lake	Not Impaired
Archbold Reservoir	Insufficient data
Barnesville Reservoir #1	Insufficient data
Barnesville Reservoir #2	Insufficient data
Barnesville Reservoir #3	Not Impaired
Beach City Reservoir	Insufficient data
Beaver Creek Reservoir	Not Impaired
Bellevue Reservoir	Insufficient data
Belmont Lake	Insufficient data
Berlin Reservoir	Insufficient data
Buckeye Lake	Not Impaired
Bucyrus Reservoir #2	Insufficient data
Burr Oak Reservoir	Not Impaired
Caesar Creek Lake	Not Impaired
Caldwell Lake	Not Impaired
Charles Mill Reservoir	Insufficient data
CJ Brown Reservoir	Not Impaired
Clark Lake	Insufficient data
Clear Fork Reservoir <sup>5</sup>	Impaired (PCBs)
Clendening Lake	Not Impaired
Confluence Park Pond # 1	Insufficient data
Confluence Park Pond # 2	Insufficient data
Confluence Park Pond # 3	Insufficient data
Cowan Lake	Not Impaired
Cutler Lake	Insufficient data
Dale Walborn Reservoir	Not Impaired

<sup>5</sup> Shaded rows indicate impaired lakes.

Water Body (Inland Lakes)	Impairment status (cause)
Daugherty Lake	Insufficient data
Dave Heisy Pond	Insufficient data
Deer Creek Reservoir (Mahoning basin)	Impaired (PCBs)
Deer Creek Reservoir (Scioto basin)	Not Impaired
Delaware Reservoir	Not Impaired
Delphos Reservoir	Insufficient data
Delta Reservoir #1	Insufficient data
Delta Reservoir #2	Insufficient data
Dillon Lake	Not Impaired
Dow Lake	Not Impaired
East Branch Reservoir	Not Impaired
East Fork Lake	Not Impaired
East Reservoir	Insufficient data
Eastwood Lake	Insufficient data
Ferguson Reservoir	Not Impaired
Findlay Reservoir #1	Insufficient data
Findlay Reservoir #2	Insufficient data
Findley Lake	Not Impaired
Forked Run Lake	Not Impaired
Fostoria #3	Insufficient data
Fox Lake	Not Impaired
Friendship Park Lake	Insufficient data
Grand Lake St. Marys	Impaired (PCBs)
Grant Lake	Insufficient data
Greenfield Lake	Not Impaired
Griggs Reservoir	Not Impaired
Hammertown Lake	Insufficient data
Hargus Lake	Insufficient data
Highlandtown Lake	Not Impaired
Hinckley Lake	Insufficient data
Hoover Reservoir	Not Impaired
Indian Lake	Not Impaired
Jackson Lake	Insufficient data
Jefferson Lake	Not Impaired
Killdeer Pond #30	Not Impaired
Killdeer Reservoir	Insufficient data
Kiser Lake	Not Impaired
Knox Lake	Insufficient data

Water Body (Inland Lakes)	Impairment status (cause)
Kokosing Lake	Insufficient data
LaDue Reservoir	Impaired (PCBs)
Lake Alma	Not Impaired
Lake Ann	Insufficient data
Lake Girard	Insufficient data
Lake Glacier	Not Impaired
Lake Hamilton	Insufficient data
Lake Hope	Not Impaired
Lake Isabella	Insufficient data
Lake Jisco	Insufficient data
Lake Katherine	Insufficient data
Lake LaComte	Insufficient data
Lake LaSuAn	Insufficient data
Lake Lavere	Insufficient data
Lake Logan	Not Impaired
Lake Loramie	Not Impaired
Lake Mel	Insufficient data
Lake Milton	Impaired (PCBs)
Lake Olander	Not Impaired
Lake Rockwell	Impaired (PCBs)
Lake Rupert	Not Impaired
Lake Snowden	Insufficient data
Lake Sue	Insufficient data
Lake Vesuvius	Not Impaired
Lake White	Not Impaired
Lake Wood Duck	Insufficient data
Lamberjack Lake	Insufficient data
Lima Lake	Insufficient data
Long Lake	Insufficient data
Lost Creek Reservoir	Insufficient data
Madison Lake	Insufficient data
Maysville Ws Reservoir	Insufficient data
McComb Reservoir #1	Insufficient data
McComb Reservoir #2	Insufficient data
Meadowbrook Lake	Insufficient data
Meander Creek Reservoir	Not Impaired
Metzger Reservoir	Insufficient data
Milton Lake	Insufficient data



Water Body (Inland Lakes)	Impairment status (cause)
Mogadore Reservoir	Not Impaired
Mosier Lake	Insufficient data
Mosquito Lake	Not Impaired
Nesmith Lake	Insufficient data
Nettle Lake	Insufficient data
New Lexington Reservoir	Insufficient data
New London Reservoir	Insufficient data
New Lyme Lake	Not Impaired
Nimisila Reservoir	Not Impaired
North Baltimore	Insufficient data
North Fork Kokosing Reservoir	Not Impaired
Norwalk Reservoir #3	Not Impaired
Oakthorpe Lake	Insufficient data
O'shaughnessy Reservoir	Not Impaired
Oxbow Lake	Insufficient data
Paint Creek Lake	Not Impaired
Paulding Reservoir	Insufficient data
Piedmont Lake	Not Impaired
Pike Lake	Not Impaired
Pine Lake	Insufficient data
PJ Outhwaite Reservoir	Insufficient data
Pleasant Hill Reservoir	Not Impaired
Powers Reservoir	Insufficient data
Punderson Lake	Insufficient data
Pymatuning Reservoir	Not Impaired
Raccoon Creek	Insufficient data
Rock Mill Reservoir	Insufficient data
Rocky Fork Lake	Not Impaired
Rose Lake	Not Impaired
Ross Lake	Not Impaired
Rush Creek Lake	Insufficient data
Rush Run Lake	Not Impaired
Salt Fork Reservoir	Not Impaired
Schoonover Reservoir	Impaired (Mercury)
Seneca Lake	Insufficient data
Shelby Reservoir #3	Insufficient data
St. Joseph Lake	Not Impaired
Stewart Lake	Insufficient data

Water Body (Inland Lakes)	Impairment status (cause)
Stonelick Lake	Not Impaired
Summit Lake	Impaired (PCBs)
Swift Run Lake	Insufficient data
Tappan Lake	Not Impaired
Turkey Creek Lake	Not Impaired
Tycoon Lake	Insufficient data
Upper Sandusky Reservoir	Insufficient data
Van Wert Reservoir #1	Insufficient data
Van Wert Reservoir #2	Insufficient data
Veteran's Memorial (Maumee basin)	Not Impaired
Veteran's Memorial (Portage basin)	Insufficient data
Veto Lake	Insufficient data
Wabash Reservoir	Insufficient data
Wellington Upground Reservoir	Insufficient data
West Branch Reservoir	Impaired (PCBs)
Westville Lake	Impaired (PCBs)
Willard Reservoir	Insufficient data
Wills Creek Reservoir	Not Impaired
Wingfoot Lake	Not Impaired
Wolf Run Lake	Insufficient data

## E4. Supplemental Information

### E4.1 Calculation of Fish Concentrations from Water Quality Standards Inputs

For carcinogens:

$$\text{Fish Concentration (mg/kg)} = \frac{\left[ \frac{\text{Cancer Risk Level}}{q1^* \left( \text{mg/kg/d} \right)^{-1}} \right] \times \text{Body Weight (kg)}}{\text{Fish Consumption (kg/d)}}$$

For noncarcinogens:

$$\text{Fish Concentration (mg/kg)} = \frac{\text{RfD (mg/kg/d)} \times \text{Body Weight (kg)} \times \text{RSC}}{\text{Fish Consumption (kg/d)}}$$

For wildlife:

$$\text{Fish Concentration (mg/kg)} = \text{Wildlife WQC (mg/L)} \times \text{BAF TL}_n \text{ (L/kg)}$$

#### Lake Erie Drainage Basin

	Mercury	Chlordane	DDT	PCBs	Hexachloro-benzene	Mirex
HHWQC	3.1 ng/L	2.4 µg/L	0.15 ng/L	0.026 ng/L	0.45 ng/L	0.074 ng/L
Wildlife Criteria	1.3 ng/L	N/A	0.011 ng/L	0.12 ng/L	N/A	N/A
The following inputs on which the WQS are based are used to calculate fish concentrations:						
Reference Dose (RfD)	1E-04 mg/kg/d	N/A	N/A	N/A	N/A	N/A
Slope Factor (q1*)	N/A	0.35 (mg/kg/d) <sup>-1</sup>	0.34 (mg/kg/d) <sup>-1</sup>	2.0 (mg/kg/d) <sup>-1</sup>	1.6 (mg/kg/d) <sup>-1</sup>	0.53 (mg/kg/d) <sup>-1</sup>
Cancer Risk Level	N/A	1E-05	1E-05	1E-05	1E-05	1E-05
Body Weight	65 kg	70 kg	70 kg	70 kg	70 kg	70 kg
Trophic Level Three Bioaccumulation Factor (BAF TL <sup>3</sup> )	27,900	116,600	376,400	520,900	43,690	353,000
Trophic Level Four Bioaccumulation Factor (BAF TL <sup>4</sup> )	140,000	154,200	1,114,000	1,871,000	71,080	1,461,000
Fish Consumption	0.015 kg/d	0.015 kg/d	0.015 kg/d	0.015 kg/d	0.015 kg/d	0.015 kg/d
Relative Source Contribution Factor (RSC)	0.8	N/A	N/A	N/A	N/A	N/A

Source: U.S. EPA. 1995. Great Lakes Water Quality Initiative Criteria Documents for the Protection of Human Health. EPA-820-B-95-006. March 1995.

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## Derivation of Concentrations

### *Lake Erie Drainage Basin Mercury Human Health Fish Concentration*

$$\frac{1\text{E} - 04(\text{mg} / \text{kg} / \text{d}) \times 65(\text{kg}) \times 0.8}{0.015(\text{kg} / \text{d})} = 0.35(\text{mg} / \text{kg}) = 350(\mu\text{g} / \text{kg})$$

### *Lake Erie Drainage Basin Mercury Wildlife Fish Concentration*

#### Trophic Level 3:

$$1.3\text{E} - 06(\text{mg} / \text{L}) \times 27,900(\text{L} / \text{kg}) = 0.036(\text{mg} / \text{kg}) = 36(\mu\text{g} / \text{kg})$$

#### Trophic Level 4:

$$1.3\text{E} - 06(\text{mg} / \text{L}) \times 140,000(\text{L} / \text{kg}) = 0.18(\text{mg} / \text{kg}) = 180(\mu\text{g} / \text{kg})$$

### *Lake Erie Drainage Basin Chlordane Human Health Fish Concentration*

$$\frac{\left[ \frac{1\text{E} - 05}{0.35(\text{mg} / \text{kg} / \text{d})^{-1}} \right] \times 70(\text{kg})}{0.015(\text{kg} / \text{d})} = 0.13(\text{mg} / \text{kg}) = 130(\mu\text{g} / \text{kg})$$

### *Lake Erie Drainage Basin DDT Human Health Fish Concentration*

$$\frac{\left[ \frac{1\text{E} - 05}{0.34(\text{mg} / \text{kg} / \text{d})^{-1}} \right] \times 70(\text{kg})}{0.015(\text{kg} / \text{d})} = 0.14(\text{mg} / \text{kg}) = 140(\mu\text{g} / \text{kg})$$

### *Lake Erie Drainage Basin DDT Wildlife Fish Concentration*

#### Trophic Level 3:

$$1.1\text{E} - 08(\text{mg} / \text{L}) \times 376,400(\text{L} / \text{kg}) = 0.0041(\text{mg} / \text{kg}) = 4.1(\mu\text{g} / \text{kg})$$

#### Trophic Level 4:

$$1.1\text{E} - 08(\text{mg} / \text{L}) \times 1,140,000(\text{L} / \text{kg}) = 0.012(\text{mg} / \text{kg}) = 12(\mu\text{g} / \text{kg})$$

### *Lake Erie Drainage Basin PCB Human Health Fish Concentration*

$$\frac{\left[ \frac{1\text{E} - 05}{2.0(\text{mg} / \text{kg} / \text{d})^{-1}} \right] \times 70(\text{kg})}{0.015(\text{kg} / \text{d})} = 0.023(\text{mg} / \text{kg}) = 23(\mu\text{g} / \text{kg})$$

### Lake Erie Drainage Basin PCB Wildlife Fish Concentration

#### Trophic Level 3:

$$1.2\text{E} - 07(\text{mg/L}) \times 520,900(\text{L/kg}) = 0.062(\text{mg/kg}) = 62(\mu\text{g/kg})$$

#### Trophic Level 4:

$$1.2\text{E} - 07(\text{mg/L}) \times 1,871,000(\text{L/kg}) = 0.22(\text{mg/kg}) = 220(\mu\text{g/kg})$$

### Lake Erie Drainage Basin Hexachlorobenzene Human Health Fish Concentration

$$\frac{\left[ \frac{1\text{E} - 05}{1.6(\text{mg/kg/d})^{-1}} \right] \times 70(\text{kg})}{0.015(\text{kg/d})} = 0.029(\text{mg/kg}) = 29(\mu\text{g/kg})$$

### Lake Erie Drainage Basin Mirex Human Health Fish Concentration

$$\frac{\left[ \frac{1\text{E} - 05}{0.53(\text{mg/kg/d})^{-1}} \right] \times 70(\text{kg})}{0.015(\text{kg/d})} = 0.088(\text{mg/kg}) = 88(\mu\text{g/kg})$$

### Ohio River Drainage Basin

	Mercury	Chlordane	DDT	PCBs	Hexachloro- benzene	Mirex
HHWQC	12 ng/L*	21 ng/L	5.9 ng/L	1.7 ng/L	7.5 ng/L	0.11 ng/L
The following inputs on which the WQS are based are used to calculate fish concentrations:						
Reference Dose (RfD)	N/A	N/A	N/A	N/A	N/A	N/A
Slope Factor (q1*)	N/A	0.35 (mg/kg/d) <sup>-1</sup>	0.34 (mg/kg/d) <sup>-1</sup>	2.0 (mg/kg/d) <sup>-1</sup>	1.6 (mg/kg/d) <sup>-1</sup>	0.53 (mg/kg/d) <sup>-1</sup>
Cancer Risk Level	N/A	1E-05	1E-05	1E-05	1E-05	1E-05
Body Weight	N/A	70 kg	70 kg	70 kg	70 kg	70 kg
Fish Consumption	N/A	0.0065 kg/d	0.0065 kg/d	0.0065 kg/d	0.0065 kg/d	0.0065 kg/d
Relative Source Contribution Factor (RSC)	N/A	N/A	N/A	N/A	N/A	N/A

\* Based on the FDA action level of 1 mg/kg divided by the BCF of 83,333 L/kg.

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#### *Ohio River Drainage Basin Mercury Fish Concentration*

1 mg/kg based on FDA action level

#### *Ohio River Drainage Basin Chlordane Fish Concentration*

$$\frac{\left[ \frac{1\text{E} - 05}{0.35(\text{mg} / \text{kg} / \text{d})^{-1}} \right] \times 70(\text{kg})}{0.0065(\text{kg} / \text{d})} = 0.31(\text{mg} / \text{kg}) = 310(\mu\text{g} / \text{kg})$$

#### *Ohio River Drainage Basin DDT Fish Concentration*

$$\frac{\left[ \frac{1\text{E} - 05}{0.34(\text{mg} / \text{kg} / \text{d})^{-1}} \right] \times 70(\text{kg})}{0.0065(\text{kg} / \text{d})} = 0.32(\text{mg} / \text{kg}) = 320(\mu\text{g} / \text{kg})$$

#### *Ohio River Drainage Basin PCB Fish Concentration*

$$\frac{\left[ \frac{1\text{E} - 05}{2.0(\text{mg} / \text{kg} / \text{d})^{-1}} \right] \times 70(\text{kg})}{0.0065(\text{kg} / \text{d})} = 0.054(\text{mg} / \text{kg}) = 54(\mu\text{g} / \text{kg})$$

#### *Ohio River Drainage Basin Hexachlorobenzene Fish Concentration*

$$\frac{\left[ \frac{1\text{E} - 05}{1.6(\text{mg} / \text{kg} / \text{d})^{-1}} \right] \times 70(\text{kg})}{0.0065(\text{kg} / \text{d})} = 0.067(\text{mg} / \text{kg}) = 67(\mu\text{g} / \text{kg})$$

#### *Ohio River Drainage Basin Mirex Fish Concentration*

$$\frac{\left[ \frac{1\text{E} - 05}{0.53(\text{mg} / \text{kg} / \text{d})^{-1}} \right] \times 70(\text{kg})}{0.0065(\text{kg} / \text{d})} = 0.20(\text{mg} / \text{kg}) = 200(\mu\text{g} / \text{kg})$$

#### **Fish Tissue Concentrations for Determining Impairment for the 2016 IR ( $\mu\text{g}/\text{kg}$ )**

	Lake Erie HH	Lake Erie – wildlife TL3	Lake Erie – wildlife TL4	Ohio River
Mercury	350	36	180	1000
Chlordane	130	N/A	N/A	310
DDT	140	4.1	12	320
PCBs	23	62	220	54
Hexachlorobenzene	29	N/A	N/A	67
Mirex	88	N/A	N/A	200

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## E4.2 What's the Difference between the Fish Consumption Advisory Decision and the Impairment Decision?

Some question may arise as to how the methodology for determining impairment status for the 2016 IR for fish tissue relates to the fish advisories issued by the State of Ohio. Rather than building on fish consumption advisory decisions, the revised methodology draws directly from the fish tissue contaminant database. This change was possible because of better accessibility to the raw data.

In short, the basis for determining impairment for the IR for fish tissue is similar but unrelated to the basis for determining advisories. The WQS calculations assume a certain amount of fish consumption and ensure that level of consumption is safe. The advisory calculations determine what level of fish consumption is safe. Therefore, both are protective of human health. However, advisories and IR impairment status are not directly related.

Advisory thresholds are given as one meal per week, one meal per month, one meal every other month and do not eat. Each threshold is associated with a particular contaminant concentration that is based on consuming an eight-ounce meal. For both PCBs and mercury, those thresholds are 50 parts per billion (ppb) for one meal per week, 220 ppb for one meal per month, 1,000 ppb for one meal every other month and 2,000 ppb for do not eat.

The thresholds used for determining IR categories are based on water quality standards for human health. The water quality standards assume that people are eating a certain quantity of different types of fish over time. The Lake Erie basin WQS calculations for mercury and PCBs assume that people are eating 15 grams of fish per day. The Ohio River basin calculations for PCBs and mercury assume that people are eating 6.5 grams of fish per day.

Advisory thresholds are prescriptive, indicating to people how much fish is safe to eat given a certain level of fish contamination. Water quality standard-based thresholds are descriptive, indicating how much contamination is acceptable in fish given that people are eating a certain amount of certain types of fish. In other words, the advisories tell people how much fish they can safely eat and the water quality standards assume how much fish people are eating and use that information to calculate a “safe” level of contamination in fish.

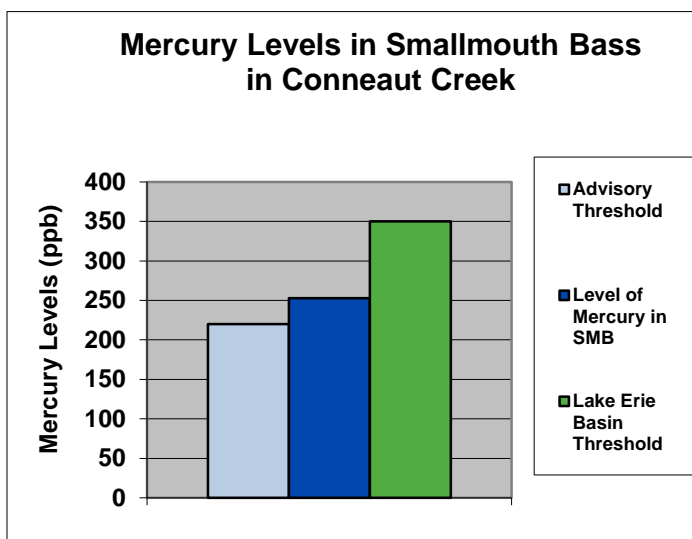
U.S. EPA, in its guidance on developing the IR, indicates that water quality standards are to be used as the basis for determining impairment categories for fish tissue. Because the assumptions used to calculate the advisories are different than the assumptions used to calculate the WQS, this results in cases where some water bodies have advisories against fish consumption but are not listed as impaired and some water bodies are listed as impaired but no fish advisory is in place. This situation is demonstrated in the following table:

Parameter	Lake Erie Basin	Ohio River Basin	1 meal per week advisory	1 meal per month advisory
Fish Consumed	15 grams/day	6.5* grams/day	32.6 grams/day	7.6 grams/day
<b>Maximum Allowable Fish Concentration</b>				
PCB Threshold	23 ppb	54 ppb	50 ppb	220 ppb
Mercury Threshold	350 ppb	1000 ppb	50 ppb	220 ppb

\* This value is under review in the current proposed WQS rule update for 3745-1. The proposed value of 17.5 g/day was used in calculating the proportion of trophic level 3 and 4 fish consumed in the Ohio River basin, but was not used in developing the thresholds for determining impairment status.

The reason the thresholds are different between the two basins is that the assumed fish consumption levels are different. The reason the water quality standard thresholds are different from the advisory thresholds is both because the fish consumption levels are different and because for PCBs, a cancer slope factor is used to calculate the water quality standard criteria, which is stricter than the health protection value used to calculate the advisory threshold.

Data for smallmouth bass in Conneaut Creek provide an example where there is an advisory but the water body is not impaired.



Channel catfish in Pymatuning Reservoir show a case where there is no advisory but the water is listed as impaired.

